FIRST WRF-NOAH CORDEX-EUROPE REGIONAL CLIMATE SIMULATION FROM 1990-2008 AT 0.11° RESOLUTION

Kirsten Warrach-Sagi, Thomas Schwitalla, Hans-Stefan Bauer, Volker Wulfmeyer
Institute of Physics and Meteorology, University of Hohenheim, Germany
Kirsten.Warrach-Sagi@uni-hohenheim.de

In order to provide high-resolution ensembles and comparisons of regional climate simulations, the World Climate Research Program (WCRP) initiated the COordinated Regional climate Downscaling Experiment (CORDEX, http://wcrp.ipsl.jussieu.fr/SF_RCD_CORDEX.html). CORDEX is performed in preparation of the fifth assessment report of the Intergovernmental Panel on Climate Change (IPCC AR5) (Giorgi et al., 2009 [1]). The verification run is performed for a 20-year period (1989-2009) driven by ERA-interim data (Simmons et al., 2007 [2], Uppala et al., 2008 [3]). The ERA-interim reanalysis corrects some errors of the ERA-40 reanalysis. It is available from 1989 onwards on a T255 spectral grid (approx. 0.75°). To date simulations from various institutions running various regional climate models (WRF, REMO, CCLM, RCA) for the CORDEX domain Europe (Fig. 1) at 0.11° are currently completed or running. The results are currently under evaluation in all groups.

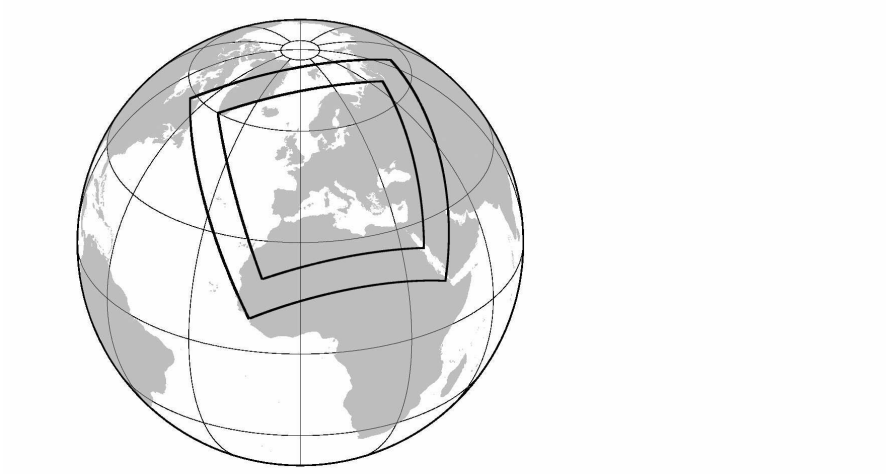

Fig 1. Domain of WRF for CORDEX Europe on a rotated grid with 0.33° (outer domain) and 0.11° resolution (inner domain). The outer domain is used for downscaling the 0.75° ERA-interim data smoothly to the 0.11° simulation grid.

Here we present our results from the first completed WRF-NOAH ERA-interim forced simulation on 0.11° for Europe within the scope of CORDEX. The advanced research version 3.1.0 of the Advanced Research Version of the Weather and Research Forecast (WRF) model (Skamarock et al., 2008 [4]) has been set up for the model domain with the land surface model NOAH (Chen and Dudhia, 2001a [5], Chen and Dudhia, 2001b [6]) within the German Science Foundation funded project PAK 346 (Structure and Functions of Agricultural Landscapes under Global Climate Change - Processes and Projections on a Regional Scale). The simulation is the first one embedded in PAK 346 to study the interaction of atmosphere and land surface at the regional climate scale. Within the PAK 346 Ingwersen et al. (2011) [7] began to improve the land surface model NOAH for cropped areas. The resulting NOAH-GECROS will be implemented into WRF beginning at the end of 2011 and the simulation will be repeated to study the impact on the land surface atmosphere interaction.

From experience with previous applications of WRF in Central Europe in the weather forecast mode (Schwitalla et al., 2011 [8]), it was decided to use the Morrison two-moment microphysical scheme and the YSU atmospheric boundary layer parameterisation. Due to the climate mode of the simulation, the CAM shortwave and longwave radiation schemes were chosen. Further the new Kain-Fritsch convection scheme is applied. The 30'' MODIS land-cover data, classified according to the International Geosphere-Biosphere Programme (IGBP), which was adapted to NOAH, was chosen for the vegetation and for the soil the 5 min. UN/FAO data, as it comes with the pre-processing package of WRF. Since the ERA interim data is available at approx. 0.75°, WRF is applied one-way nested on 0.33° and 0.11° with a time stepping of 120 s and 60 s, respectively.
The evaluation focuses on Germany due to the availability of high resolution precipitation and temperature data from the German Weather Service for the simulation period. The precipitation shows a wet bias in many regions, which is lowest in summer and largest at the mountain ranges and the lowlands of northeastern Germany. However, the precipitation distribution itself is well captured in space.

References

[1] F. Giogi *et al.*, 2011, *Q. J. R. Meteorol. Soc.*, 137, 156-175.
[2] A.J. Simmons *et al.*, 2007. *ECMWF Newsletter*,110, 25–35.
[3] S. Uppala *et al.*, 2008. *ECMWF Newsletter*, 115, 12–18.
[4] W.C. Skamarock *et al.*, 2008, *NCAR Technical Note TN-475+STR, NCAR,Boulder/CO*.
[5] F. Chen and J. Dhudia, 2001a, *Mon. Wea. Rev.*, 129, 569-585.
[6] F. Chen and J. Dhudia, 2001b, *Mon. Wea. Rev.*, 129, 587-604.
[7] J. Ingwersen *et al.*, 2011, *Agric. For. Meteorol.*, 151, 345-355.
[8] T. Schwitalla *et al.*, 2011, *Q. J. R. Meteorol. Soc.*, 137, 156-175.